

SUB-COMMITTEE ON STABILITY AND
LOAD LINES AND ON FISHING VESSELS
SAFETY
54th session
Agenda item 3

SLF 54/INF.4
14 October 2011
ENGLISH ONLY

DEVELOPMENT OF SECOND GENERATION INTACT STABILITY CRITERIA

Research into stability failure modes and associated criteria development

Submitted by the United States

SUMMARY

Executive summary: This document provides the technical basis for document SLF 54/3/3 and an overview of the research covered by a key report titled "Development of second generation intact stability criteria". The main research objectives were to develop draft vulnerability criteria that reflect the physical phenomena of the four stability failure modes of parametric roll, pure loss of stability, surf-riding/broaching, and the dead ship condition, perform calculation on 17 sample ships to test the draft criteria, and to prepare initial information on methods for direct stability assessment. The report also provides the technical basis for proposed vulnerability criteria. Information is also provided by which the full text of the report may be obtained.

Strategic direction: 5.2

High-level action: 5.2.1

Planned output: 5.2.1.16

Action to be taken: Paragraph 7

Related documents: SLF 54/3/3; SLF 53/WP.4, SLF 53/3/7, SLF 53/3/8 and SLF 53/INF.10

Background

1 This document presents an overview of the Report of research performed by the Naval Warfare Center Carderock Division (NSWCCD – David Taylor Model Basin, Seakeeping Division, Code 5500) that was commissioned by the Naval Architecture Division of the Office of Design and Engineering Standards of the United States Coast Guard (CG 521). The objective of this research was to support United States participation in and contribution to the SLF plan of action for matters related to intact stability (document SLF 53/WP.4, annex 4) associated with the stability failure modes of parametric roll, pure loss of stability, surf-riding/broaching, and the dead ship condition. In particular, the

development and testing of the level 1 and 2 vulnerability criteria for the first three stability failures modes was the top priority of this work. This Report describes the United States contribution to this development and also contains a justification of the United States position on dead ship condition criteria, as well as an overview of possible methods for direct stability assessment procedures.

2 As the development of the second generation intact stability criteria proceeds, clear communication of the motivations, objectives, and approaches of this development becomes paramount for the success of this enterprise. To facilitate this communication, the main part of the Report consists of a three-tiered structure that addresses each of the four stability failure modes (sections 3 to 6). The first subsection of each of these sections is an executive level, graphic-based brief explanation of the physical background of each of the phenomena. The second subsection in each of these sections describes the main mathematical model that was used to develop the criteria; the second subsection was intended to be addressed to regulators and class society engineers who would like to gain deeper understanding of the ongoing development. The rest of the sections describe the technical details of the methods.

3 The report provides draft vulnerability criteria, levels 1 and 2, for parametric roll, pure loss of stability, and surf-riding/broaching. All six of the vulnerability criteria were tested on sample population of 17 ships including five container carriers, two fishing vessels, two bulk carriers, two general cargo vessels, two naval vessels, a passenger RoPax ferry, a passenger cruise vessel, an LNG carrier and a tanker. Several of those ships had known vulnerabilities to these phenomena. The essence of testing was to see if the proposed criteria for a particular stability failure mode would be able to distinguish ships with known vulnerabilities from ships known to be safe. The proposed criteria were tested successfully.

4 Vulnerability criteria for the dead ship condition were considered. The report concluded that, due to complex physical nature of ship response in dead ship conditions, parameters of the current weather criterion underwent significant calibration using a certain population of ships typical for the time of the development of current weather criterion. As a result, the modification of the current weather criterion is not advisable.

5 The report also includes an overview of the methods for direct stability assessment. These are methods of numerical simulation of model testing that are capable of addressing the extreme rarity of stability failures, without incurring impractical expenses. It was shown that the application of the principle of separation allows for practical solution.

6 The report may be obtained in Portable Data Format (PDF) from the United States Coast Guard Office of Design and Engineering Standards, Naval Architecture Division (CG-5212) web page using the following URL: <http://www.uscg.mil/hq/cg5/cg5212/>.

Action requested of the Sub-Committee

7 The Sub-Committee is invited to note the information provided.

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SLF 54/INF.4/Corr.1
10 November 2011
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Corrigendum

Submitted by the United States

Paragraph 6 of document SLF 54/INF.4 is replaced by the following:

"6 The Report may be obtained in Portable Data Format (PDF) from the United States Coast Guard Office of Design and Engineering Standards, Naval Architecture Division (CG-5212) web page using the following URL: <http://www.uscg.mil/hq/cg5/cg5212/docs/dtmb-2ndgen-is-rpt2011.pdf>."